

Sediment-associated pesticides and toxicity in the Irrigated Lands Conditional Waiver program

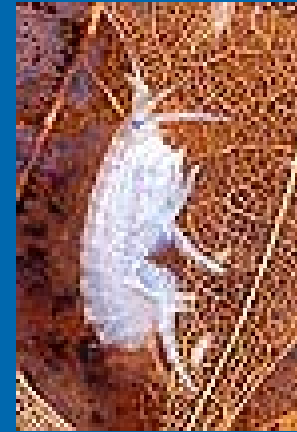
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*(including some data provided by
Pacific EcoRisk)*



The tools:

Hyalella toxicity test



- Briefly: Bring sediment in to the lab, add Hyalella, count survivors after 10 days.
- In use in U.S. since at least 1984.
- Nationally standardized protocols, routinely used by many labs throughout U.S.
- One of two species used for freshwater sediment testing (the other = Chironomus).

The tools: Sediment chemistry

- Sediment analyses for organochlorines, organophosphates, and metals all with fairly routine methods.
- Sediment analyses for pyrethroids possible since at least 1992.
- Pyrethroid analytical methods published, but no standard methods promulgated by EPA.
- At least a half dozen (and probably more) academic and governmental labs analyze for pyrethroids routinely.
- Commercial lab capability is minimal because of no prior market demand.

Pyrethroid detection limits in sediment

Thresholds for Hyalella acute toxicity (simplified by assumptions):

Cypermethrin, bifenthrin, lambda-cyhalothrin = 3 ppb

Deltamethrin = 6 ppb

Cyfluthrin, esfenvalerate = 8 ppb

Permethrin, fenpropathrin = 80 ppb

Watch the detection limits when monitoring sediment!

One commercial lab offering 25 ppb

All current and prior DPR monitoring at 10 ppb
(efforts underway to reduce this limit)

Our state-sponsored monitoring at 1 ppb (expecting
it will soon be lowered further)

Results from Central Valley monitoring in ag-dominated water bodies

Drawing on data from:

UCB studies for CALFED, Ag Waiver
Phase 1, Ag Waiver Phase 2

Pacific EcoRisk coalition group
monitoring

Pacific EcoRisk and UCB PRISM
sampling

Analysis does not include SWAMP data

Frequency of Hyalella sediment toxicity in Central Valley

Project	Year	Lab	# smpl	% smpl toxic	% sites toxic
Calfed	02-03	UCB	33	24	33
AW 1	03	UCB	32	28	41
AW 2	04-05	UCB	62	16	18
Coalition grp.	04-05	PE	45	33	--
PRISM	04-05	PE/UCB	26	27	23
ALL ABOVE COMBINED			198	25	25

Distribution of toxicity by water body type (UCB data only)

Type	# smpl	% toxic
River	11	9
Creeks	42	31
Creeks excluding westside tribs	33	15
Sloughs	33	12
Canals	6	0
Named ditches/drains	21	19
Unnamed ditches/drains	42	33

Identifying the contributors to sediment toxicity: Sediment TIEs

- EPA releasing sediment Toxicity Identification Evaluation (TIE) procedures in Fall '05 (likely to target only broad categories like organics or metals)
- Several local labs developing procedures specific for pyrethroids. We anticipate testing in summer 2005 state-sponsored sampling. Broad availability in 2006.

Identifying the contributors to sediment toxicity: TU analysis

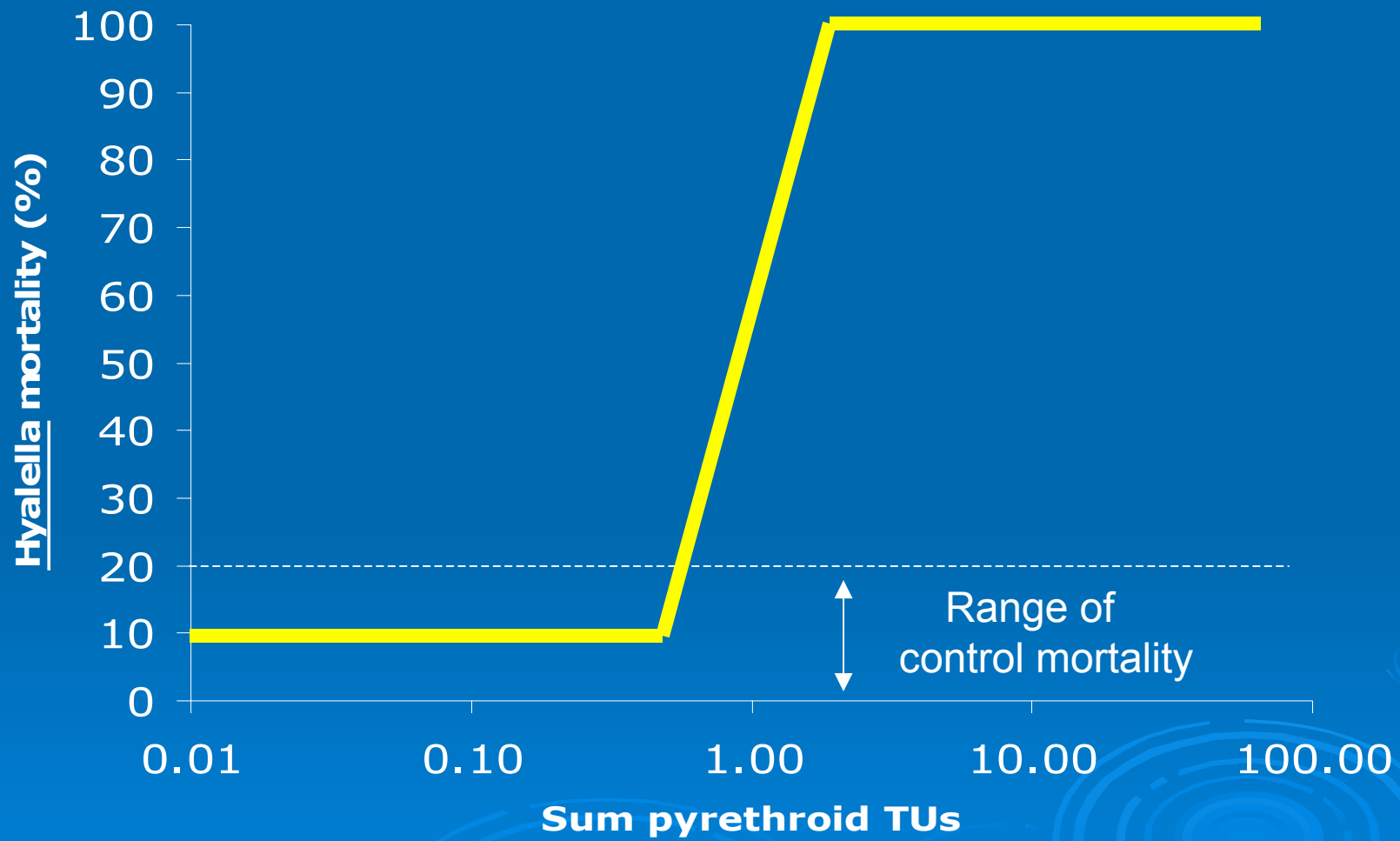
$$\text{Toxicity Unit (TU)} = \frac{\text{Actual conc. in sediment}}{\text{Published Hyalella LC50 conc.}}$$

TUs calculated on an organic carbon normalized basis

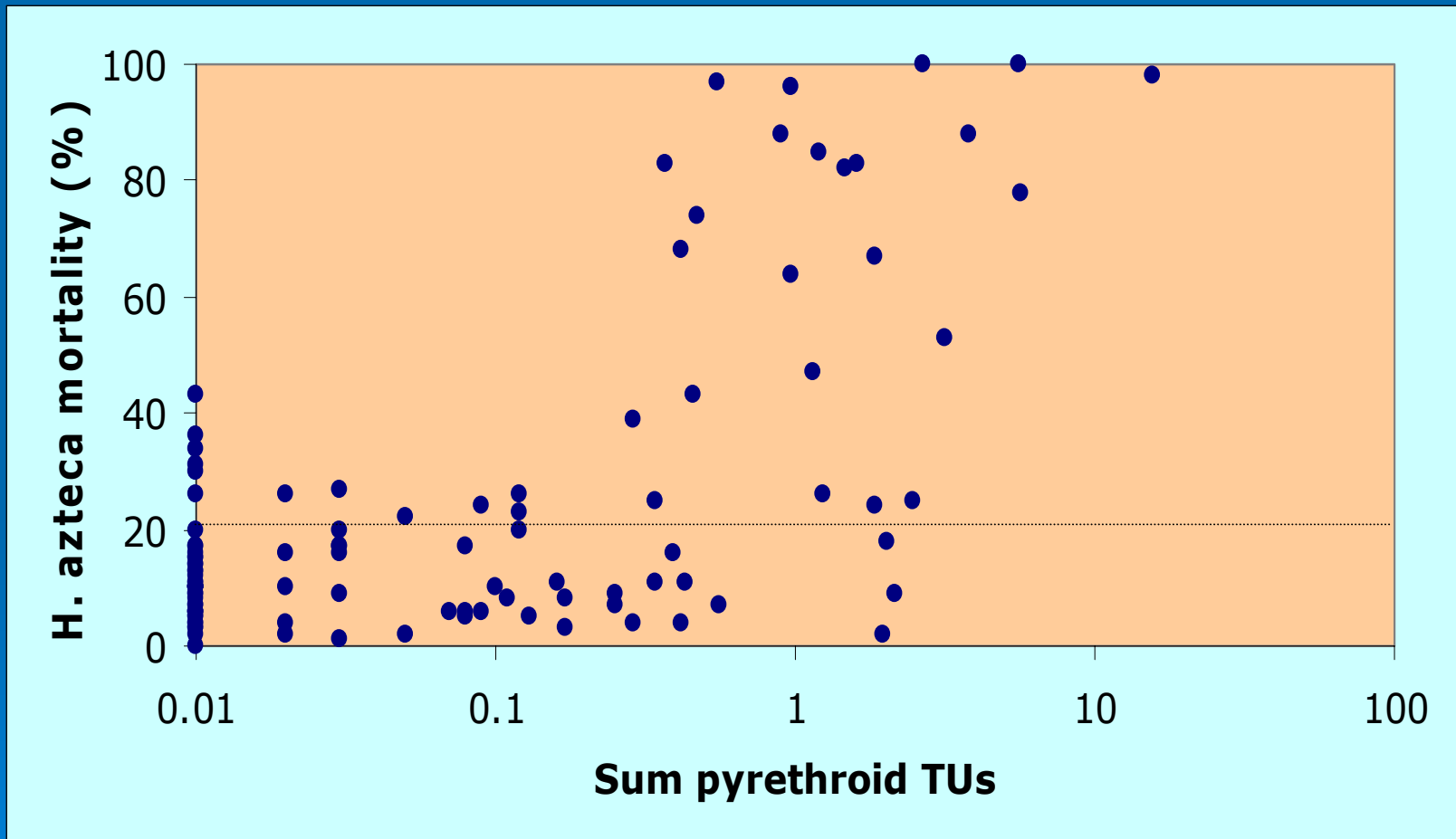
Hyalella LC50s for pyrethroids measured in Weston lab using 3 Central Valley sediments.

What analytes exceed 0.5 TU?

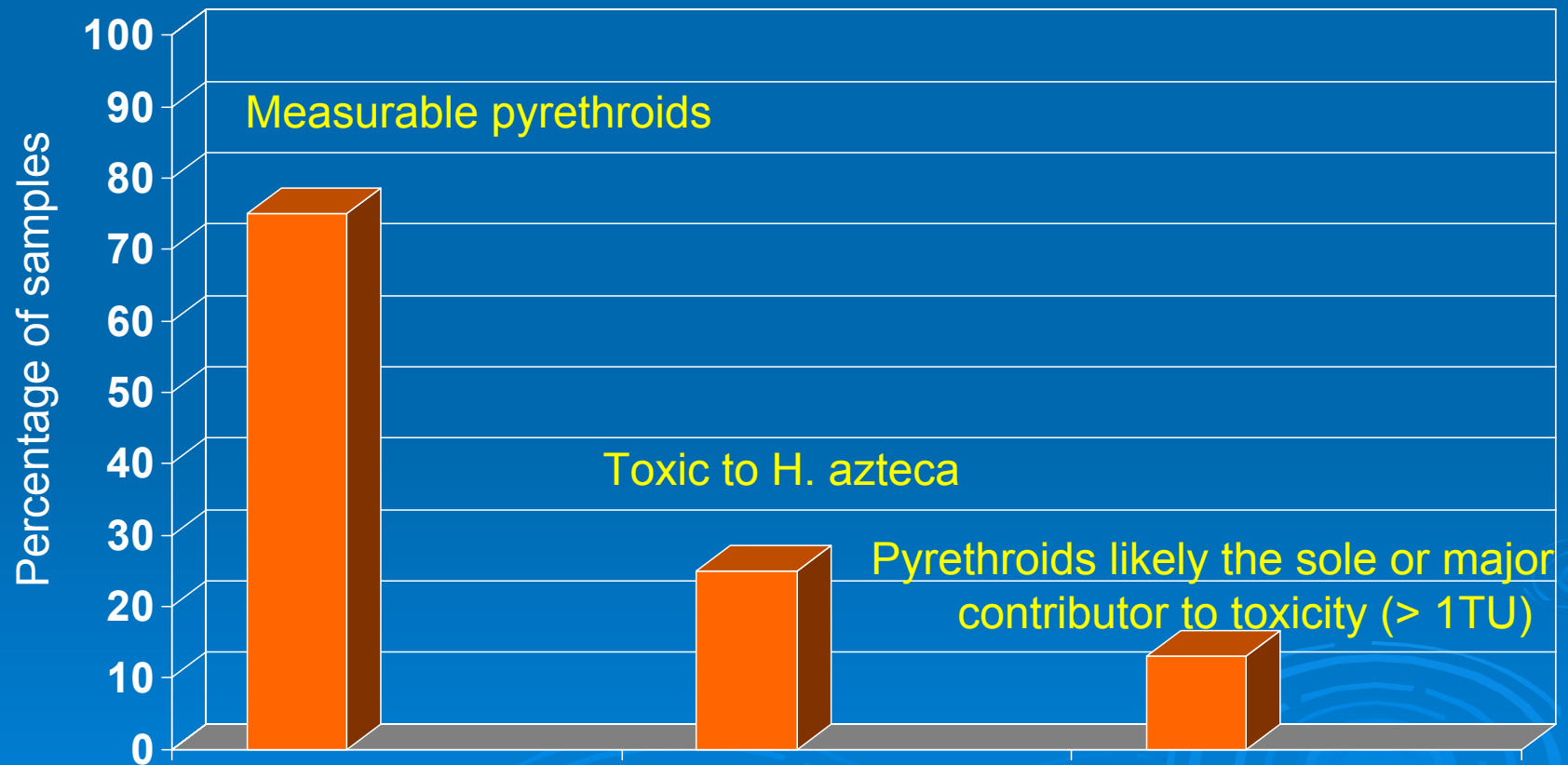
Compound	# smpl >0.5 (out of 108)	Maximum TU
DDT, DDD, DDE	0	0.1
Endosulfan	0	<0.01
Methoxychlor	0	0.3
BHC	0	0.3
Dieldrin	0	0.02
Endrin	1	0.5
Chlorpyrifos	???	???
Bifenthrin	12	13.3
Lambda-cyhal.	8	2.5
Esfenvalerate	5	1.8
Permethrin	3	0.7
Cyflu, Cyper, Delta	0	<0.25



All agricultural samples combined



Grand totals from all our agricultural sediment samples



Sediment Focus Group issues

- Group recommends use of only Hyalella survival endpoint (not growth) for ILP monitoring.
- Consensus among group is that chemical analysis should be done on samples demonstrating toxicity. Details remain to be resolved, and implementation should wait until 2006 irrigation season.

Sediment chemistry issues to be resolved

- Toxicity threshold for chemical analysis (<80% survival?).
- Should be phased analyses, possibly with pyrethroids and organophosphates in first phase, and organochlorines and metals in later phase(s).
- Costs about \$300/sample for pyrethroids and \$200 for each of the other groups.
- No commercial lab capability yet demonstrated for pyrethroids though a couple labs are on the verge of offering the capability.